CLAIMS

I claim:

1. A system for the monitoring work cycles of moving equipment comprising:

a position locating assembly coupled to an moving equipment, said position locating assembly determining a current position of the moving equipment on an interval basis;

a data storage means operationally coupled to said position locating assembly for recording said current position for each interval; and

a data processing means for processing and presenting said position information for a user.

2. The system of claim 1, further comprising a user input device for providing an indication that the moving equipment is actively operating, said input device being operationally coupled to said data storage means for recording a start and a stop position for each active use of the moving equipment.

3. The system of claim 1, further comprising a operational map of the area to be operated upon by the moving equipment, said operational map being operationally linked to said position locating assembly.

4. The system of claim 3, further comprising a visual display unit assembly for providing a navigation aid to the operator of the moving equipment for facilitating accurate operations on the area in accordance with a predetermined plan.

5. A system for the monitoring work cycles of moving equipment comprising:

a position locating assembly coupled to an moving equipment, said position locating assembly determining a current position of the moving equipment on an interval basis;

a data storage means operationally coupled to said position locating assembly for recording said current position for each interval;

a data processing means for processing and presenting said position information for a user;

a user input device for providing an indication that the moving equipment is actively operating, said input device being operationally coupled to said data storage means for recording a start and a stop position for each active use of the moving equipment;

a operations map of the area to be operated upon by the moving equipment, said operating map being operationally linked to said position locating assembly; and

a visual display unit assembly for providing a navigation aid to the operator of the moving equipment for facilitating accurate operations upon the area in accordance with a predetermined plan, said visual display unit assembly being operationally coupled to said position locating assembly.

6. The system of claim 5, wherein said position locating means further comprises a position locating system selected from the group of position locating systems consisting of global positioning system (GPS), long range navigation (LORAN), and inertial navigation system (INS).

7. The system of claim 5, wherein said position locating assembly further comprises:

a housing couplable to the moving equipment, said housing having an interior space;

at least one global positioning system (GPS) receiver, said GPS receiver being positioned substantially within said housing such that said housing providing protection from an external environment;

at least one antenna operationally coupled to said GPS receiver, said antenna facilitating reception of GPS signals by said GPS receiver.

8. The system of claim 5, wherein said data storage means comprises data transfer device selected from the group of data transfer devices consisting of a personal computer memory card international association (PCMCIA) data storage card, a compact flash card, a smart media card, for providing a transportable nonvolatile storage of said position information for each interval.

9. The system of claim 5, wherein said data storage means further comprises a compact flash data storage card for providing transportable nonvolatile storage of said position information for each interval.

10. The system of claim 9, wherein said compact flash card being operationally coupled to said visual display unit for providing a reference grid for navigating through operating by the moving equipment such that a current position as determined by said position locating assembly being compared to said reference

grid facilitates a course correction presented by said visual display unit.

11. The system of claim 5, wherein said data processing means further comprises:

a personal computer for processing information;

a operations map in a machine readable format for facilitating analysis of paths traveled by the moving equipment;

a track software for developing an overlay of stored present location information for each interval against said operations map.

12. The system of claim 11, wherein said personal computer further comprises a data transfer receiving slot selected from the group of data transfer receiving slots consisting of personal computer memory card international association (PCMCIA) data storage card slot, compact flash card reader, and smart media card reader, for selectively connecting with a data transfer device for facilitating transporting current position information for each interval from said position locating assembly to said personal computer for facilitating analysis.

13. The system of claim 11, wherein said personal computer further comprises a compact flash card reader for selectively connecting with a data transfer device for facilitating transporting current position information for each interval from said position locating assembly to said personal computer for facilitating analysis.

14. The system of claim 5, wherein said data processing means further comprises:

a laptop computer for processing information;

a operations map in a machine readable format for facilitating analysis of paths traveled by the moving equipment;

a track software for developing an overlay of stored present location information for each interval against said operations map.

15. The system of claim 14, wherein said laptop computer further comprises a data transfer receiving slot selected from the group of data transfer receiving slots consisting of personal computer memory card international association (PCMCIA) data storage card slot, compact flash card reader, and smart media card reader, for selectively connecting with a data transfer device for facilitating transporting current position information for each interval from said position locating assembly to said personal computer for facilitating analysis.

16. The system of claim 11, wherein said laptop computer further comprises a compact flash card reader for selectively connecting with a data transfer device for facilitating transporting current position information for each interval from said position locating assembly to said personal computer for facilitating analysis.

17. The system of claim 5, further comprising:

said position locating assembly further comprises:

a housing couplable to the moving equipment, said housing having an interior space;

at least one global positioning system (GPS) receiver, said GPS receiver being positioned substantially within said housing such that said housing providing protection from an external environment;

at least one antenna operationally coupled to said GPS receiver, said antenna facilitating reception of GPS signals by said GPS receiver;

said data storage means comprises a compact flash card for providing a transportable nonvolatile storage of said position information for each interval;

wherein said compact flash card being operationally coupled to said visual display unit for providing a reference grid for navigating through operating by the moving equipment such that a current position as determined by said position locating assembly being compared to said reference grid facilitates a course correction presented by said visual display unit;

said data processing means further comprises:

a personal computer for processing information;

a operations map in a machine readable format for facilitating analysis of paths traveled by the moving equipment;

a track software for developing an overlay of stored present location information for each interval against said operations map; and

said personal computer further comprises a compact flash card reader for selectively connecting with a compact flash card for facilitating transporting current position information for each

interval from said position locating assembly to said personal computer for facilitating analysis.

18. The system of claim 17, wherein said track software developing a graphic representation of each swath traveled by the moving equipment.

19. The system of claim 18 wherein said graphic representation provides an indication for active use of the moving equipment contrasting from swaths where the moving equipment was not actively used, said active use being determined by a start and stop indication from said user input device.

20. The system of claim 18, wherein said graphic representation providing an indication of the moving equipment remaining in a static position for a duration of more than a predetermined number of intervals.

21. The system of claim 17, wherein said interval having a duration of between 1 and 3600 seconds inclusive, said interval being determinable prior to operation.

22. The system of claim 17, wherein said visual display unit having a plurality of light emitting diodes positioned in an array for providing a visual indication of the path to be traveled compared with the swath being taken whereby the operator of the moving equipment has a navigation aid on a swath by swath basis.

23. The system of claim 17, wherein said visual display unit being a liquid crystal display for providing a visual indication of the path to be traveled compared with the swath being taken whereby the operator of the moving equipment has a navigation aid on a swath by swath basis.

24. The system of claim 23, wherein said visual display unit said data processing means and said data storage means each being positioned within a single display housing, said processing means being operationally coupled to said data storage means, said visual display unit and said user input device for providing a simplified user system.

25. The system of claim 17, further comprising a volume determining means operationally coupled to said data storage means for determining a volume of material being moved by said moving equipment.

26. The system of claim 25, wherein said volume determining means comprises a sound wave transceiver for projecting sound waves against the material being moved and receiving sound waves bouncing off of the material such that a difference between transmit time and receive time determines a distance traveled and whereby a volume occupied by the material is determined.

27. The system of said 26 wherein said sound wave transceiver being an ultrasonic transceiver for minimizing environmental effects on the accuracy of said sound wave transceiver.

28. The system of claim 25, wherein said volume determining means further comprises a plurality of sound wave generators and a plurality of sound wave receivers, said sound wave generators being for projecting sound waves against the material being moved, said sound wave receivers being for receiving sound waves from an associated one of said plurality of sound wave generators bouncing off of the material such that a difference between transmit time and receive time determines a distance traveled and whereby a volume occupied by the material is determined for each area associated with a pairing of associated sound wave generator and sound wave receiver.

29. The system of claim 28, further comprising:

wherein said plurality of sound wave generators comprises a plurality of ultrasonic sound wave generators for minimizing environmental effects on the accuracy of said volume determining means;

wherein said plurality of sound wave receivers comprises a plurality of ultrasonic sound wave receivers for minimizing environmental effects on the accuracy of said volume determining means; each one of said plurality of ultrasonic receivers being operationally pairs with an associated one of said ultrasonic sound wave generators.

30. The system of claim 25, wherein said volume determining means further comprises a laser transceiver for projecting light waves against the material being moved and receiving light waves bouncing off of the material such that a difference between transmit time and receive time determines a distance traveled and whereby a volume occupied by the material is determined.

31. The system of claim 17, further comprising a weight determining means operationally coupled to said data storage means for determining a weight of material being moved by said moving equipment.

32. The system of claim 17, wherein said data storage means being operationally couplable to said data processing means via a coupling means such that stored information may be transferred to said data processing means from said data storage means.

33. The system of claim 32, wherein said coupling means being a coupling means selected from the group consisting of an electrical signal connection, an optical signal connection, a radio link, an infrared link, and a cellular modem system.

34. The system of claim 32, wherein said coupling means being a cellular modem system for facilitating periodic updates during a work cycle of the moving equipment for analysis.

35. The system of claim 17, wherein said data storage means being for recording current position, time and supplemental data on an interval basis.

36. The system of claim 35, wherein said supplemental data further comprises volume of material being moved, changes in volume of material, weight of material being moved, material loaded, and material unloaded, said supplemental data being used to augment analysis of said position and time data for determining efficiency of work cycles.

37. A method of monitoring moving equipment comprising:

providing a position locating assembly couplable to a piece of moving equipment, said position location assembly determining a current position of the moving equipment on an interval basis;

providing a data storage means for recording the position data for each interval;

obtaining a operations map for the area to be operated upon by the moving equipment;

providing a data processing means for processing the position data for each interval into a graphic representation for facilitating analysis by a user.

38. The method of claim 37, wherein said step of providing a position locating assembly further comprises providing a position locating system selected from the group of position locating systems consisting of global positioning system (GPS), long range navigation (LORAN), and inertial navigation system (INS).

39. The method of claim 37, wherein said step of providing a position locating assembly further comprises:

providing at least one global positioning system (GPS) receiver, said GPS receiver being couplable to the moving equipment;

providing at least one antenna operationally coupled to said GPS receiver for facilitating reception of GPS signals by said GPS receiver;

determining a duration of an interval period between position determinations by said GPS receiver.

40. The method of claim 39, wherein said step of determining a duration of an interval period further comprises selecting an duration having a length of between 1 and 3600 seconds inclusive.

41. The method of claim 37, wherein said step of providing a data storage means further comprises providing a compact flash card operationally coupled to said position locating assembly for recording current position data for each interval, said compact flash card facilitating transportation of said position data in a nonvolatile format.

42. The method of claim 41, wherein said compact flash card being operationally coupled to a visual display unit for providing a navigation aid for an operator of the moving equipment comparing a current position during a swath with a predetermined path represented on a operations map.

43. The method of claim 37, wherein said step of providing a data storage means further comprises providing a data transfer device selected from the group of data transfer devices consisting of compact flash card, smart media card, and personal computer memory card international association (PCMCIA) data storage card, said data transfer device facilitating transportation of said position data in a nonvolatile format.

44. The method of claim 37, further comprising:

providing a user input device for generating a start and stop reference point for each swath indicating an active use of the moving equipment;

activating said user input device at the start of a swath;

recording a current position corresponding to the start of the swath;

completing the swath with the moving equipment;

activating said user input device at the end of the swath;

recording a current position corresponding to the end of the swath.

45. The method of claim 37, further comprising:

transferring the position data from said data storage means to said data processing means;

overlaying said position data onto said operations map;

processing said data into a graphical representation;

generating an output display highlighting anomalous events for facilitating analysis of said data by the user.

46. The method of claim 45, wherein said anomalous events include any anomalous event selected from the list of anomalous events comprising multiple identical position data for consecutive intervals, swaths not actively using the moving equipment, or inefficient crossing through paths on said operations map.

47. The method of claim 37, further comprising:

providing a volume determining means, said volume determining means being operationally coupled to said data storage means, said volume determining means being used to determine a volume of material being moved by the moving equipment; and

recording said volume on an interval basis along with said current position.

48. The method of claim 47, wherein said step of providing a volume determining means further comprises:

providing at least one sound wave transceiver;

projecting sound waves against the material being moved; and

receiving sound waves bouncing off of the material such that a difference between transmit time and receive time determines a distance traveled and whereby a volume occupied by the material is determined.

49. The method of claim 48, wherein said step of providing at least one sound wave transceiver further comprises:

providing a plurality of ultrasonic sound wave generators;

projecting ultrasonic sound waves against the material being moved;

providing a plurality of ultrasonic sound wave receivers;

receiving ultrasonic sound waves from an associated one of said plurality of ultrasonic sound wave generators bouncing off of the material;

determining a difference between transmit time and receive time;

calculating a distance traveled, whereby a volume occupied by the material is determined for each area associated with a pairing of associated ultrasonic sound wave generator and ultrasonic sound wave receiver.

50. The method of claim 37, further comprising:

providing a weight determining means, said weight determining means being operationally coupled to said data storage means, said weight determining means being used to determine a weight of material being moved by the moving equipment; and

recording said weight on an interval basis along with said current position.

51. The method of claim 37, further comprising providing a coupling means for operationally coupling to said data processing means to said data storage means such that stored information may be transferred to said data processing means from said data storage means.

52. The system of claim 51, wherein said coupling means being a coupling means selected from the group consisting of an electrical signal connection, an optical signal connection, a radio link, an infrared link, and a cellular modem system.

53. The system of claim 51, wherein said coupling means being a cellular modem system for facilitating periodic updates during a work cycle of the moving equipment for analysis.